Forest Planning & Architectural Design

Proposal for a

Common Sustainable Practices, Monitoring and Reporting Method

in Forest Planning and Architectural Design

29/03/2024

Preface

This document is considered as a first version of a work in progress. Its aim is to provide a proposal for a common sustainable practices, monitoring and reporting method in Forest Planning and Architectural Design. This method is shared by the forestry and construction industries to better measure, evaluate and adjust their activities for better sustainability, throughout the processes that involves the architectural project.

It is presented in the form of a proposal and seeks to leave the discussion open for its further development. This document has been developed around academic architectural projects over the last three years, and results of active dialogue with Member State experts and key stakeholders. The author sought for a broader perspective, intertwining knowledge from different fields of expertise and geographical horizons. Architects, engineers, biologists, environmentalists, foresters and sawyers to name a few, from France, Sweden, Finland, Switzerland, Germany and Belgium have been approached.

A possible next step for further development would be the implementation of the method. This could take place with the design of a wooden building, involving architects, forest owners, engineers and a sawmill around an architectural project.

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1. Why is there a need for sustainable Forest Planning and Architectural Design?

Forests provide us with oxygen and purify the air we breathe. They filter water and are our greatest ally when it comes to tackle climate change. They sequester and store carbon, including in long-lived wood products they can offer. If we always have relied on them for the reasons mentioned above, forests become highly important to help our society to leave a Fossil Economy for a fossil-free alternative. This transition comes with a high and increasing demand on wooden products. Forests are under heavy pressure. A new fossil-free economic has to be fully aligned with our environment's natural dynamics.

Historically, our forest management practices and methods have been seeking for productivity, measured by the production of wood for economic purposes. With industrialisation came artificial, monospecific and even-aged planted forests structures. Natural, heterogeneous and dynamic forests have slowly been replaced by such plantations. In 2020, 75% of European forests have an even-aged structure[1]. Forestry favouring artificial structures have noticeable impacts on forests' health and ecosystems. It affects forest stability, resistance and resilience to climate change led traumatic events such as droughts, wildfires, disease and pest outbreaks. It decreases species diversity, both in terms of flora and fauna that rely on specific species and tree states and forest growth stage. This can be explained by the homogenisation of the forest that lead to a lack of old components such as deadwood, habitat trees and old trees. The simplification of forests structure also alters the spread of underground fungal communities, having ultimately a negative impact on forest's natural regeneration capacities.

In addition to the issues mentioned above, forests are suffering stress resulting of human activities with forestry and agricultural practices. The expansion of agricultural fields and built environment leads to forest fragmentation. The way we harvest forests causes carbon release in the atmosphere, mainly coming from soil erosion and humus disturbance. Forest soil is subject to compaction and rutting, having impacts on water flows and retention. If forest management approaches are changing with the recognition of environmental and socials values of forests, there is a need for a transition for sustainable forestry practices.

Almost 40 years ago, the United Nations Brundtland Commission defined sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." This definition has become globally a common target in most of disciplines. However, there are still nuances, levels of depth and different interpretations when it comes to define if a material, product, process, project, practice or policy is truly sustainable. In architecture, a wooden building is not inevitably sustainable. From the delivered building to the seed hidden in a pine cone, there are hundreds of parameters, isolated and put together that have to be taken into consideration in order to conclude that in the end, a wooden building is sustainable or not. The theoretical definition of sustainability has to develop into a practical solution adapted to specific fields and context. In our case, a solution that ties architectural design and forest planning to ensure that the whole process of building with wood is sustainable.

Dealing with the whole process implies to set a common framework that defines variables and key stakeholders. This proposal seeks to bridge the latest EU forest policies together around the method that it develops. It states considerations, defines objectives, principles and targets, identifies benefits and proposes a practical way of implementation of the method.

2. Considerations

2.1. Key terms and definitions

- Above-ground biomass: All biomass of living vegetation, both woody and herbaceous, above the soil including stems, stumps, branches, bark, seeds, and foliage[2].

- Below-ground biomass: All biomass of live roots. Fine roots of less than 2 mm diameter are excluded because these often cannot be distinguished empirically from soil organic matter or litter[2].

- Canopy cover: The percentage of the ground covered by a vertical projection of the outermost perimeter of the natural spread of the foliage of plants[2].

- Carbon in above-ground biomass: Carbon in all living biomass above the soil, including stems, stumps, branches, bark, seeds, and foliage[2].

- Carbon in below-ground biomass: Carbon in all biomass of live roots. Fine roots of less than 2 mm diameter are excluded, because these often cannot be distinguished empirically from soil organic matter or litter[2].

- Carbon in dead wood: Carbon in all non-living woody biomass not contained in the litter, either standing, lying on the ground, or in the soil. Dead wood includes wood lying on the surface, dead roots down to 2 mm, and stumps larger than or equal to 10 cm in diameter[2].

- Carbon in litter: Carbon in all non-living biomass with a diameter less than the minimum diameter for dead wood (e.g. 10 cm), lying dead in various states of decomposition above the mineral or organic soil[2].

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[1] Forest Europe. (2020). *State of Europe's Forests 2020.* https://foresteurope.org/wp-content/uploads/2016/08/SoEF_2020.pdf

- Closer-to-Nature Forest Management: Set of practices to ensure multifunctional forests by combining biodiversity goals, carbon stock preservation and timber-related revenues[3].

- Deadwood: All non-living woody biomass not contained in the litter, either standing, lying on the ground, or in the soil. Dead wood includes wood lying on the surface, dead roots, and stumps larger than or equal to 10 cm in diameter or any other diameter used by the country[2].

- Disturbance: Damage caused by any factor (biotic or abiotic) that adversely affects the vigour and productivity of the forest and which is not a direct result of human activities[2].

- Ecosystem functions: Ecological processes that control the flows of energy, nutrients and organic matter through an environment[3].

- Ecosystem services: The suite of benefits that ecosystems provide to humanity, either in regulatory, supporting, cultural or provisioning terms[3].

- Forest: Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use[2].

- Forest biodiversity: Species and populations that are found only in forests or that are particularly sensitive or threatened by forest management practices. The composition of forest species and the genetic diversity of populations of a given species are largely determined by the type of forest management practiced[3].

- Forest ownership: Generally refers to the legal right to freely and exclusively use, control, transfer, or otherwise benefit from a forest. Ownership can be acquired through transfers such as sales, donations, and inheritance[2].

- Forest policy: A set of orientations and principles of actions adopted by public authorities in harmony with national socio-economic and environmental policies in a given country to guide future decisions in relation to the management, use and conservation of forest for the benefit of society[2].

- Logging: This class includes employment in logging and the output of this activity can take the form of logs, chips or fire wood[2].

- Native tree species: A tree species occurring within its natural range (past or present) and dispersal potential (i.e. within the range it occupies naturally or could occupy without direct or indirect introduction or care by humans)[2].

- Non wood forest product: Goods derived from forests that are tangible and physical objects of biological origin other than wood[2].

- Plantation forest: Planted Forest that is intensively managed and meet ALL the following criteria at planting and stand maturity: one or two species, even age class, and regular spacing[2].

- Planted forest: Forest predominantly composed of trees established through planting and/or deliberate seeding[2].

- Primary forest: Naturally regenerated forest of native tree species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed[2].

- Protected areas: Forest area within protected areas that has a long-term (ten years or more) documented management plan, aiming at defined management goals, and which is periodically revised[2].

- Sustainable forest management: A dynamic and evolving concept, [that] is intended to maintain and enhance the economic, social and environmental value of all types of forests, for the benefit of present and future generations[2].

- Traceability system for wood products: A system that provides the ability to trace the origin, location and movement of wood products by means of recorded identifications. This involves two main aspects: (1) identification of the product by marking, and (2) the recording of data on movement and location of the product all the way along the production, processing and distribution chain[2].

- Tree: A woody perennial with a single main stem, or in the case of coppice with several stems, having a more or less definite crown[2].

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[2] Food and Agriculture Organization of the United Nations. (2020). *Terms and Definitions FRA 2020*. https://www.fao.org/3/I8661EN/i8661en.pdf

[3] European Commission, Directorate-General for Environment, (2023). *Guidelines on closer-to-nature forest management*, Publications Office of the European Union. https://data.europa.eu/doi/10.2779/731018

2.2. Forest management sustainable practices

This section refers to the European Commission's Guidelines on Closer-to-Nature Forest Management[4], published on the 27/07/2023.

The aim of these guidelines is to promote biodiversity-friendly and adaptive forest management as part of a common framework for Closer-to-Nature forest management. They have been written to assist competent authorities and key stakeholders in developing and promoting biodiversity-friendly and adaptive practices in forest management across different scales, discussing challenges and opportunities. These guidelines are for forests that have a commercial use for timber and non-timber forest products, and that are not explicitly designated as protected areas.

The following points have been selected as key sections of European Commission's Guidelines on Closer-to-Nature Forest Management in relation to the method developed in this proposal.

Promoting natural tree regeneration

- Natural regeneration should be the prevailing approach to regenerate forests.
- Natural regeneration promotes genetic diversity in the forest and thus promotes the adaptive resilience of forest stands.
- Artificial regeneration may be needed to complement natural regeneration in specific situations[5].
- Forest regeneration does not depend on the regeneration of the vegetation exclusively but requires a broader approach covering all forest ecosystems. For example, when soils are severely degraded or are under a very active degradation process, these problems may need to be addressed before artificial or natural regeneration can successfully take place.

Ensuring respectful harvest conditions

- When planning harvesting operations, it is necessary to take account of the need to preserve all the functions of the forest. This should be achieved by respecting all parts of the forest ecosystem (in particular, the soil, watercourses, and other natural environments within the forest and their buffer zones).
- It should also be achieved by respecting all the individual trees and their ecological functioning in the stand, whether they are mature individuals, poles or seedlings.

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[4] European Commission, Directorate-General for Environment, (2023). *Guidelines on closer-to-nature forest management*, Publications Office of the European Union. https://data.europa.eu/doi/10.2779/731018

[5] Larsen, J. B. et al. (2022). *Closer-to-nature forest management. From science to policy 12*. European Forest Institute. https://doi.org/10.36333/fs12

- When harvesting wood, any intensive practice must be avoided as much as possible and subject to thorough qualitative analyses in relation to biodiversity benefits and increasing carbon stock capacity in the forest ecosystem and in the harvested wood products.
- The technique proposed by multifunctional approaches to promote diverse stands is partial harvesting (i.e. single-tree selection, group selection, or gap cuts (max. 0.2-0.5 ha)) mimicking natural disturbance patterns, as opposed to 'clear-cutting' larger areas.
- Small openings in selection gap cuts (max. 0.2-0.5 ha) can create suitable climatic conditions for species that prefer semi-shaded or semi-open conditions and enrich the forest structure.
- Decisions on the timing and location of small openings should reflect a mosaic approach to avoid small openings that are next to each other or within a short distance of each other and that could cumulate to have effects similar to a larger clear-cut scenario.
- During harvest, buffer zones along streams should be set to reduce the impacts of harvesting on water courses in the forest[6].
- Primary and old-growth forests remaining in the EU should be strictly protected considering their high value for both biodiversity and climate change mitigation[7].

Minimising other management interventions

- External inputs should be kept to a minimum and their composition carefully chosen to avoid sudden changes in the pH or nutrient content of the soil.

Preserving and restoring soil and water ecosystems in forests

- The impacts of heavy machinery and the building of access roads hamper the natural regeneration of forest soil, thus must be avoided as much as possible by promoting minimal intervention techniques.
- Protecting natural landforms and geomorphic processes is the basis of healthy soils, but it is also the basis of healthy aquatic ecosystems that make it possible to reduce the impact of droughts on surrounding ecosystems and human activity.

Optimising deadwood retention

- After deadwood volume, the type of deadwood and its stage of decay are the next most important features of deadwood for species promotion.
- Leaving enough deadwood in the forest in all stages of decomposition (including standing dead and dying trees (...)) is therefore an important measure for biodiversity restoration and conservation.

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[6] Kuglerová, L. et al. (2020). Cutting edge: A comparison of contemporary practices of riparian buffer retention around small streams in Canada, Finland, and Sweden. *Water Resources Research*, *56*(9), Article e2019WR026381. https://doi.org/10.1029/2019WR026381

[7] Barredo, J. I. et al. (2021). *Mapping and assessment of primary and old-growth forests in Europe*. Publications Office of the European Union. https://data.europa.eu/doi/10.2760/797591

- After deadwood volume, the type of deadwood and its stage of decay are the next most important features of deadwood for species promotion.
- Leaving enough deadwood in the forest in all stages of decomposition (including standing dead and dying trees (...)) is therefore an important measure for biodiversity restoration and conservation.
- Actual volumes, density and locations should be decided with consideration given to fire management, safety aspects (recreation), and the control of pest outbreaks guided by biological knowledge, management objectives, and the situation in a particular stand (forest type, basal area of living trees, stand age, natural disturbances and species composition).

Setting areas aside

- Voluntary set-aside areas can be a measure to support closer-to-nature forest management.

Taking a scale-specific approach

- The management needs to take account of three levels: (i) the level of individual trees and groups of trees; (ii) the level of the stand; and (iii) the level of the landscape.

  (i) The level of individual trees and groups of trees

  Management measures specified for individual trees or groups of trees should take account of their role in the forest ecosystem throughout their life cycle. During forestry management operations, each tree or group of trees should therefore be evaluated in terms of its usefulness. Criteria for harvesting should consider the trees' role in the ecosystem and should balance climate, environmental, social and economic criteria in line with the overall objectives of: (i) restoring and conserving biodiversity; and (ii) promoting resilience against climate change.

  (ii) The level of the stand

  The size of a stand can vary from a few to several hectares. Commonalities for delineating a stand should be chosen in line with the stand's closer-to-nature objectives. These objectives could include vertical complexity, soil fertility, tree age or dominant tree species.

  (iii) The level of the landscape

  Promoting structural complexity and the heterogeneity of a forest ecosystem is also relevant at landscape level.

  In addition to environmental benefits, landscape-scale management enables economies of scale on certain services and investments, creating synergies across ownership and balancing the different interests of different players.

  For wood harvesting, a mosaic approach to landscape-level management of forests also makes it possible to balance exploitation intensity with biodiversity restoration, conservation and climate change resilience.

Managing ungulate species at natural carrying capacity

- Promoting or maintaining ground vegetation can help to reduce grazing pressure on seedlings and saplings.
- It is necessary to protect existing or expected seedlings so as not to jeopardise the future of the forest in areas where damage by ungulate species is such as to compromise the renewal and natural diversity of the forest.

2.3. Forest management strategies

This section refers to European Commission's New EU Forest Strategy for 2030[8], published on the 14/07/2021.

Forests are under increasing pressures resulting from natural processes and human activities. We are witnessing a tree cover loss. With climate change come pests, pollution and diseases, promoting forest fires. This new EU Forest Strategy aims to overcome these challenges and unlock the potential of forests for our future, in full respect for the principle of subsidiarity, best available scientific evidence and Better Regulation requirements. It is anchored in the European Green Deal and the EU 2030 Biodiversity Strategy and it recognises the central and multi-functional role of forests, and the contribution of foresters and the entire forest-based value chain for achieving by 2050 a sustainable and climate-neutral economy while ensuring that all of ecosystems are restored, resilient, and adequately protected.

The following points have been selected as key sections of European Commission's New EU Forest Strategy for 2030 in relation to the method developed in this proposal.

2. Supporting the socio- economic functions of forests for thriving rural areas and boosting forest-based bio-economy within sustainability boundaries

- Sustainably produced and long-lived wood-based products can help to achieve climate neutrality.
- Optimise the use of wood in line with the cascading principle.
- Short-lived wood products and energy also play a role, especially in substituting fossil-based counterparts. Should rely on wood that is unsuitable for long-lived products and on secondary biomass.
- Respect for circular economy principles also crucial: better using, reusing and recycling all wood-based products.
- Supply of wood products should be in synergy with improving the conservation status of forests, and preserving and restoring biodiversity for forest resilience, climate adaptation and forest multifunctionality.

2.1. Promoting sustainable forest bioeconomy for long-lived wood products

- Forest sector holds significant economic potential for improving production of sustainable and legally harvested wood for circular and long lived materials and products.
- Promoting forest management practices, production tools and processes that are better adapted to different future forest resources.

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[8] European Commission. (2021). *New EU forest strategy for 2030. COM. (2021) 572 final. Communication from the commission to the European parliament, the council, the European Economic and social committee and the committee of the regions.* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0572

- Wood processing industries should be supported to better adapt to the changing and diversifying resources of forests.
- The most important role of wood products is to help turn the construction sector from a GHG source to a sink.
- The Commission will develop a 2050 roadmap for reducing whole life-cycle carbon emissions in buildings.
- Construction engineers and architects should be incentivised to design buildings with wood. Construction companies, following the principles of life cycle thinking and circularity, should reflect the full benefits of wooden construction in their risk premiums and business models.
- Research and innovation on architecture, green design and construction materials should be amplified.
- Regulatory approaches (e.g., for fire safety) also need attention.
- Incentives for carbon sequestration should include actions and use of long-lived wood products in the full respect of biodiversity objectives.

2.2. Ensuring sustainable use of wood-based resources for bioenergy

- Bioenergy will continue to have a notable role to play in the energy mix, if biomass is produced sustainably and used efficiently, in line with overall availability of wood within sustainability boundaries.
- The overall objective of the Union should be to ensure that the share of forest-based bioenergy remains within the limits of sustainability its possible negative externalities are adequately mitigated.

2.3. Promoting non-wood forest- based bioeconomy, including ecotourism

- The potential of non-wood products and services for generating additional revenues to the owning communities can be further supported.
- Nature tourism and well-being services provide an opportunity to accelerate the green transition of the tourism sector and provide significant income opportunities in rural areas, while further promoting biodiversity conservation and the preservation of carbon stocks.

2.4. Developing skills and empowering people for sustainable forest-based bioeconomy

- The increasing multifunctional role that forests will play in the transition to a sustainable and climate neutral future will require an increased skill-set, among others, experts in enhanced sustainable forest management practices, architects, engineers and designers, food experts, data specialists, chemists, ecotourism facilitators.

3. Protecting, restoring and enlarging EU's forests to combat climate change, reverse biodiversity loss and ensure resilient and multifunctional forest ecosystems

- In light of climate change and biodiversity loss there is an urgent need for adaptive forest restoration and ecosystem-based management approaches that strengthen the resilience of EU forests.
- This is also a great economic opportunity as forest owners and managers are properly supported in the transition.
- We need robust approaches to risk reduction in the context of significant uncertainty. The awareness of climate change by forest owners and managers needs to be increasingly translated into actions and management practices.

3.1. Protecting EU's last remaining primary and old-growth forests

- All primary and old-growth forests in particular will have to be strictly protected.
- There is still an immediate need to map the primary and old-growth forests and establish their protection regime.

3.2. Ensuring forest restoration and reinforced sustainable forest management for climate adaptation and forest resilience

- Forest management practices that preserve and restore biodiversity lead to more resilient forests that can deliver on their socio-economic and environmental functions. Therefore, all forests should be increasingly managed so that they are sufficiently biodiverse.
- There are significant opportunities for win-win measures, which simultaneously improve forest productivity, timber production, biodiversity, carbon sink function, healthy soil properties and climate resilience.
- Management practices that support biodiversity and resilience are essential, such as the creation or maintenance at stand and landscape level of genetically and functionally diverse, mixed-species forests, especially with more broadleaves and deciduous trees and with species with different biotic and abiotic sensitivities and recovery mechanisms following disturbances, instead of monocultural plantations.
- Management practices like uneven-aged and continuous-cover forestry, sufficient quantities of deadwood, regulation of wildlife densities and the establishment of protected habitat patches or set aside areas in production forests help ensure long-term environmental and socio-economic viability of forests.
- In addition, forest related risk management practices, such as integrated landscape fire management systems will increase forest resilience against wildfires, pests, diseases and create other positive spill over effects.
- Conversely, some other practices, such as clear-cutting, should be approached with caution, notably these which affect above ground biodiversity, and cause the loss of carbon in the roots and part of the carbon in the soil.
- Undue use of unsuitable machinery that cause negative environmental impacts such as soil compaction should be avoided.
- The Commission will develop a "closer-to-nature" voluntary certification scheme, so that the most biodiversity friendly management practices could benefit from an EU quality label.

3.3. Re- and afforestation of biodiverse forests

- There is potential for extending forest and tree coverage in the EU through active and sustainable re- and afforestation and tree planting.
- It is important to capitalise on this potential as enhanced afforestation is also among the most effective climate change and disaster risk mitigation strategies and can create substantial job opportunities. Also, exposure to green and forested areas can greatly benefit people's physical and mental health.

3.4. Financial incentives for forest owners and managers for improving the quantity and quality of EU forests

- Strengthened forest protection and restoration and more biodiversity friendly management are the right thing to do, but will not happen without the engagement of forest owners and managers. The right thing to do must also be economically viable.
- Forest owners and managers need drivers and financial incentives to provide also ecosystem services and

to increase the resilience of their forests.

- Member States are specifically encouraged to set up a payment scheme for ecosystem services for forest owners and managers.

4. Strategic forest monitoring, reporting and data collection

- The information concerning the status of forests in the EU, is patchy and there is insufficient planning for the forests. This leads to a situation where, on the one hand, Member States have agreed at EU level to rely to a great extent on forests and forest-based bioeconomy and on the other hand, there is no strategic framework, which would make it possible to demonstrate that the EU is on the right track and that the forests can actually deliver on their multiple demands and functions.
- The Commission will put forward a legislative proposal for a Forest Observation, Reporting and Data Collection framework as an EU-wide integrated forest monitoring framework.
- Monitoring should be regular and on more frequent cost-efficient reporting and update of data on priority EU policy-relevant topics, such as effects of climate change, biodiversity, health, damages, invasive alien species, forest management, and the biomass use for different socio-economic purposes.
- The share of forest areas covered by forest management plans (FMPs) should cover all managed public forests and an increased number of private forests.

5. A strong research and innovation agenda to improve our knowledge on forests

- Research and innovation will increase the effectiveness of enhanced sustainable forest management under changing climate conditions, among others, by reinforcing the knowledge on climate change impacts, contributing to a greater diversity of forests and genetic resources, and providing evidence-based and practically feasible guidance for climate change mitigation and adaptation in line with biodiversity objectives.
- The Commission will work with Member States to strengthen the role of forestry in the European Innovation Partnership-AGRI. The aim will be to accelerate the uptake of forest related innovations, to promote knowledge exchange, cooperation, education, training and advice in support of enhanced sustainable forest management practices and unlock the socio-economic and environmental potential of forests in rural areas.

6. Inclusive and coherent EU forest governance framework

- The wider contribution of forests to the European Green Deal objectives necessitates a more inclusive and better coordinated EU forest governance structure, reflecting all the objectives of the new EU Forest Strategy and their interlinkages. Given the increasing interest of the European public in the future of EU's forests, transparency of the governance should also be guaranteed.

7. Stepping up implementation and enforcement of existing EU acquis

- The implementation and enforcement of the EU acquis of relevance for forests and forest management issues needs to be stepped up, for instance, the Habitats and Birds Directives, the EU Timber Regulation and many more.
- Illegal logging is particularly worrying when it concerns primary and old growth forests or forest habitats with very small areas left due to the irreversibility of the damage.

2.4. Timber traceability

This section refers to the European Parliament and the Council of the European Union's regulation on the making available on the Union market and the export from the Union of certain commodities and products associated with deforestation and forest degradation and repealing Regulation (EU) No 995/2010[9], published on the 31/05/2023.

Deforestation and forest degradation are the result of the expansion of agricultural land, which is linked to the production of the commodities covered by this regulation. As a major consumer of these commodities, the EU can reduce its contribution to global deforestation and forest degradation by making sure these products and their supply chains are deforestation free. The regulation sets out binding rules for European Union (EU) operators and traders that place on the EU market or export from the EU wood, rubber, cattle, coffee, cocoa, palm oil and soy, with the aim being to minimise the EU contribution to global deforestation and forest degradation, and reduce the EU contribution to greenhouse gas emissions and global biodiversity loss. The regulation is part of the EU's biodiversity strategy for 2030, the EU's new EU forest strategy for 2030 and the European Green Deal.

The following points have been selected as key sections of European Parliament and the Council of the European Union's regulation on the making available on the Union market and the export from the Union of certain commodities and products associated with deforestation and forest degradation and repealing Regulation (EU) No 995/2010 in relation to the method developed in this proposal.

Article 3 – Prohibition

Relevant commodities and relevant products shall not be placed or made available on the market or exported, unless all the following conditions are fulfilled:

(a) they are deforestation-free;

(b) they have been produced in accordance with the relevant legislation of the country of production; and

(c) they are covered by a due diligence statement.

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[9] Regulation (EU) 2023/1115 of the European Parliament and of the Council of 31 May 2023 on the making available on the Union market and the export from the Union of certain commodities and products associated with deforestation and forest degradation and repealing Regulation (EU) No 995/2010 (Text with EEA relevance). (2023). *Official Journal*, L 150, 206-247. ELI:http://data.europa.eu/eli/reg/2023/1115/oj[legislation]

Article 4 – Obligation of operators

1. Operators shall exercise due diligence in accordance with Article 8 prior to placing relevant products on the market or exporting them in order to prove that the relevant products comply with Article 3.

Article 5 – Obligations of traders

3. SME traders shall collect and keep the following information relating to the relevant products they intend to make available on the market:

(a) the name, registered trade name or registered trade mark, the postal address, the email address and, if available, a web address of the operators or the traders who have supplied the relevant products to them, as well as the reference numbers of the due diligence statements associated to those products;

(b) the name, registered trade name or registered trade mark, the postal address, the email address and, if available, a web address of the operators or the traders to whom they have supplied the relevant products.

Article 8 – Due diligence

2. The due diligence shall include:

(a) the collection of information, data and documents needed to fulfil the requirements set out in Article 9;

(b) risk assessment measures as referred to in Article 10;

(c) risk mitigation measures as referred to in Article 11.

Article 9 – Information requirements

1. Operators shall collect information, documents and data which demonstrate that the relevant products comply with Article 3 (...):

(a) a description, including the trade name and type of the relevant products as well as, in the case of relevant products that contain or have been made using wood, the common name of the species and their full scientific name; the product description shall include the list of relevant commodities or relevant products contained therein or used to make those products;

(b) the quantity of the relevant products; for relevant products entering or leaving the market;

(c) the country of production and, where relevant, parts thereof;

(d) the geolocation of all plots of land where the relevant commodities that the relevant product contains, or has been made using, were produced, as well as the date or time range of production;

(e) the name, postal address and email address of any business or person from whom they have been supplied with the relevant products;

(f) the name, postal address and email address of any business, operator or trader to whom the relevant products have been supplied;

(g) adequately conclusive and verifiable information that the relevant products are deforestation-free;

(h) adequately conclusive and verifiable information that the relevant commodities have been produced in accordance with the relevant legislation of the country of production, including any arrangement conferring the right to use the respective area for the purposes of the production of the relevant commodity.

2. The operator shall make available to the competent authorities upon request the information, documents and data collected under this Article.

Article 10 – Risk assessment

1. Operators shall verify and analyse the information collected in accordance with Article 9 and any other relevant documentation. On the basis of that information and documentation, the operators shall carry out a risk assessment to establish whether there is a risk that the relevant products intended to be placed on the market or exported are non- compliant.

2. The risk assessment shall take into account, in particular, the following criteria:

(a) the assignment of risk to the relevant country of production or parts thereof in accordance with Article 29;

(b) the presence of forests in the country of production or parts thereof;

(c) the presence of indigenous peoples in the country of production or parts thereof;

(d) the consultation and cooperation in good faith with indigenous peoples in the country of production or parts thereof;

(e) the existence of duly reasoned claims by indigenous peoples based on objective and verifiable information regarding the use or ownership of the area used for the purpose of producing the relevant commodity;

(f) prevalence of deforestation or forest degradation in the country of production or parts thereof;

(g) the source, reliability, validity, and links to other available documentation of the information referred to in Article 9(1);

(h) concerns in relation to the country of production and origin or parts thereof (...);

(i) the complexity of the relevant supply chain and the stage of processing of the relevant products, in particular difficulties in connecting relevant products to the plot of land where the relevant commodities were produced;

(j) the risk of circumvention of this Regulation or of mixing with relevant products of unknown origin or produced in areas where deforestation or forest degradation has occurred or is occurring;

(k) conclusions of the meetings of the Commission expert groups supporting the implementation of this Regulation, as published in the Commission's expert group register;

(l) substantiated concerns submitted under Article 31, and information on the history of non-compliance of operators or traders along the relevant supply chain with this Regulation;

(m) any information that would point to a risk that the relevant products are non-compliant;

(n) complementary information on compliance with this Regulation (...).

Article 11 – Risk mitigation

1. Except where a risk assessment carried out in accordance with Article 10 reveals that there is no or only a negligible risk that the relevant products are non-compliant, the operator shall, prior to placing the relevant products on the market or exporting them, adopt risk mitigation procedures and measures that are adequate to achieve no or only a negligible risk. Such procedures and measures may include any of the following:

(a) requiring additional information, data or documents;

(b) carrying out independent surveys or audits;

(c) taking other measures pertaining to information requirements set out in Article 9.

2. Operators shall have in place adequate and proportionate policies, controls and procedures to mitigate and manage effectively the risks of non-compliance of relevant products identified. Those policies, controls and procedures shall include:

(a) model risk management practices, reporting, record-keeping, internal control and compliance management, including the appointment of a compliance officer at management level for non-SME operators;

(b) an independent audit function to check the internal policies, controls and procedures referred to in point (a) for all non-SME operators.

Article 22 – Reporting

1. By 30 April of each year, Member States shall make available to the public and to the Commission information on the application of this Regulation during the previous calendar year.

Article 29 – Assessment of countries

1. This Regulation establishes a three-tier system for the assessment of countries or parts thereof. For that purpose, Member States and third countries, or parts thereof, shall be classified into one of the following risk categories:

(a) “high risk”, (b) “low risk” and (c) “standard risk”.

Article 31 – Natural or legal persons’ substantiated concerns

1. Natural or legal persons may submit substantiated concerns to competent authorities when they consider that one or more operators or traders are not complying with this Regulation.

2.5. Criteria

In order to ensure consistency, and allow for evaluations and comparisons, this section defines a list of criteria to be used for forest mapping and monitoring. Aligned with the guidelines defined section 9. *Guidelines* of the proposal, these criteria have to be strictly represented in a forest for it to be considered healthy enough to maintain conditions for biodiversity to thrive and consider the method of this proposal respected.

• Native species: Native tree species show great capacities to support forest resilience. They have adapted overtime and many generations to local conditions of the environment. They support and have evolved alongside local biodiversity. Therefore, they are key to maintain forest biodiversity and structural complexity.

• Canopy cover: The canopy cover surface represents the area of a land that is under the vertically projected tree crowns. The tree crowns closure represents the density of the canopy, which can varies from sparse to dense. The forest canopy plays an important role in defining conditions for microhabitats, one being filtering light that reaches the ground. Light access is a crucial variable to enable natural regeneration of trees in the understorey.

2.6. Quality variables

In addition to the criteria previously mentioned are here defined a list of quality variables. If they do not have to be strictly respected, these variables will provide deeper data on forest’s natural qualities and composition. Aligned with the guidelines defined section 9. *Guidelines* of the proposal, they will help during monitoring to analyse forest’s structural dynamics and guide practices to maintain or improve forest’s health and natural qualities.

• Deadwood: Deadwood plays an important role in the forest ecosystem by serving as a natural habitat, a nutrient pool, water storage and a precursor of soil organic matter for several thousand species. In addition, deadwood accumulation is positively correlated with higher stand age and greater growing-stock volume, and it has also been found to be linked to higher quality in forest soils[10,11].

• Old or large trees: A tree is qualified as “old” when it reaches 3/4 of the maximum age known for the species based on local site conditions. A tree is qualified as “large” when it reaches 3/4 of the maximum diameter as breast height dimension known for the species based on local site conditions. Old trees host specific ecosystems, provide profitable below-ground conditions for tree natural regeneration and bear seeds in their canopy. They have high social values, carrying historical and cultural heritage.

• Stand origin: Forest stands can originate from natural regeneration or planted forests. Stands that originate from natural regeneration show great natural qualities that support local ecosystem services. Stands that originate from planted forests can acquire such qualities overtime when they reach natural structural heterogeneity.

• Structural complexity: This is linked to the forest age or management regime. Old growth forests are generally characterised by structural complexity. This can include a multilayer canopy structure, horizontal structural diversity and soil microrelief structures such as mounds caused by uprooting[12].

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[10] European Commission, Directorate-General for Environment, (2023). *Guidelines on closer-to-nature forest management*, Publications Office of the European Union. https://data.europa.eu/doi/10.2779/731018

[11] Bujoczek, L. et al. (2021). *How much, why and where? Deadwood in forest ecosystems: The case of Poland.* Ecological Indicators, 121, Article 107027. https://doi.org/10.1016/j. ecolind.2020.107027

- Habitat trees: Habitat trees are defined as a "distinct, well delineated structure occurring on living or standing dead trees, that constitutes a particular and essential substrate or life site for species or species communities during at least a part of their life cycle to develop, feed, shelter or breed"[13].

- Indicator species: A forest can host rare species found in a certain forest type, as well as endangered species including species on the red list of the International Union for Conservation of Nature (IUCN). Such species has to be identified in the mapping process.

- Resilient trees: Highlight tree's resilience to climate change analysing tree decaying. This observation requires an understanding of trees' architectural characteristics and architecture models and relies on the ARCHI diagnostic[14]. A tree is considered resilient when overcoming a stress to go back to a normal growth, or presents a crown dieback with a regenerative dynamic.

- Biomass volume: A tree is composed of below-ground and above-ground biomass. Below-ground biomass corresponds to its roots system. Above-ground biomass includes tree's trunk, branches, stem and foliage. All these are components that need to be taken into consideration in forest management practices.

- Regeneration patches: Resulting of natural regeneration, the patches can vary in sizes and ages. They are very valuable and ensure forest's succession. At early stages, they will be approached at a stand level. The stem exclusion stage that will occur later on will enable a more specific approach at a tree level.

- Seed bearing trees: A tree starts producing fruits and flowers when it reaches maturity. The age when reaching maturity depends on the tree species and local conditions. It reaches a peak in productivity then declines when trees move on in their life cycle. Seed bearing trees are essential to ensure natural regeneration.

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[12] European Commission, Directorate-General for Environment. (2023). *Commission guidelines for defining, mapping, monitoring and strictly protecting EU primary and old-growth forests.* Publications Office of the European Union, 2023, https://data.europa.eu/doi/10.2779/481811

[13] Larrieu L. et al. (2022). *Key factors determining the presence of Tree-related Microhabitats: A synthesis of potential factors at site, stand and tree scales, with perspectives for further research.* Forest Ecology and Management, 515 (2022) 120235. doi.org/10.1016/j.foreco.2022.120235.

[14] CNPF. (2010). *La Méthode ARCHI*. https://www.cnpf.fr/nos-actions-nos-outils/outils-et-techniques/archi#

2.7. Forest inventoring

This section refers to the European Commission's proposal for a regulation on a monitoring framework for resilient European forests[15], published on the 22/11/2023.

The general objective of this initiative is to develop an EU-wide monitoring framework for resilient European forests, which will seek to, as a general objective related to the implementation of Article 191 TFEU, contribute to the EU commitment to combat climate change and achieve sustainability goals, and improving the level of preservation, protection and quality of the environment. This will be achieved by ensuring more data-driven decision and policy-making on forests, which is expected to increase public trust in forest management, reduce illegal logging, incentivise and reward more sustainable forest management, and support the adaptation of forests to climate change, therefore contributing to the Commission policy priorities outlined in strategic policy documents such as the EU Biodiversity Strategy, the Adaptation Strategy and the New Forest Strategy for 2030. This initiative is about better data, knowledge and planning but does not impose on forest management policy choices and objectives of the Member States.

The following points have been selected as key sections of the European Commission's proposal for a regulation on a monitoring framework for resilient European forests in relation to the method developped in this proposal.

2.7.1. Mapping and monitoring

Article 1 – Subject matter

1. This Regulation lays down a forest monitoring framework for the Union by providing for rules:
    (a) Ensuring timeliness, accuracy, consistency, transparency, comparability and completeness of forest data within the Union and their public accessibility;
    (b) Supporting the voluntary development of integrated long-term plans at the level of the Member States through an evidence-based, inclusive, cross-sectoral and adaptive approach;
    (c) Setting up a strengthened governance between the Commission and the Member States.
2. This Regulation lays down rules for collecting and making accessible information to support:
    (d) The implementation of Union legislation and policies pertaining to the conservation, restoration and sustainable use of forest ecosystems and their services, with particular attention

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[15] European Commission, Directorate-General for Environment. (2023). *COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT REPORT Accompanying the proposal for a Regulation of the European Parliament and of the Council on a monitoring framework for resilient European forests.* Publications Office of the European Union, 2023. https://data.europa.eu/doi/10.2779/481811

to the objective of increasing forest resilience and enabling to safeguard the multifunctionality of forests, including in relation to: climate change adaptation and mitigation, biodiversity, disaster risk prevention and management, forest health, forest biomass use for different socio-economic purposes, invasive alien species;

(e) National forest management and integrated long-term planning by the Member States, *inter alia*, to increase forest resilience against wildfires, pests, droughts and other disturbances.

Article 3 – Forest monitoring system

1. The Commission shall set up, in cooperation with the Member States in accordance with Article 11, and operate a forest monitoring system comprising the following elements:

   (a) a geographically explicit identification system for the mapping and localisation of forest units, as set out in Article 4;
   (b) a forest data collection framework, as set out in Articles 5 and 8;
   (c) a forest data sharing framework, as set out in Article 7;

2. The forest monitoring system shall consist of electronic databases and geographic information systems and shall enable the exchange and integration of forest data with other electronic databases and geographic information systems (...).The forest monitoring system shall ensure the regular and systematic collection of:

   (a) forest data on the basis of aerial or space-borne ortho-imagery, by Copernicus Sentinel satellites or other equivalent systems;
   (b) in situ data through a network of monitoring sites.

Article 4 – Geographically explicit identification system for forest units

1. The Commission shall set up the geographically explicit identification system for the mapping and localisation of forest units (the 'identification system').

2. The identification system shall be a geographic information system. The Commission shall establish and regularly update the identification system on the basis of aerial or space-borne ortho-imagery data, with a uniform standard that guarantees a level of accuracy that is at least equivalent to that of cartography at a scale of 1:100 000.

3. The identification system shall:

   (a) enable the precise mapping and localisation of forest areas and, subject to the establishment of methodologies pursuant to Article 8(3), of other wooded land across the Union;
   (b) uniquely identify forest units on the basis of a combination of forest data referred to in Article 5(2) and Article 8(1);
   (c) facilitate the detection and location of change between land containing and not containing forest.

Article 5 – Forest data collection framework

2. The Commission shall collect the following forest data in accordance with the technical specifications set out in Annex I, thereby ensuring the standardisation of the data:

   (a) forest area;

   (a) tree cover density;
   (b) forest type;
   (c) forest connectivity;
   (d) defoliation;
   (e) forest fires;
   (f) wildfire risk assessment;
   (g) tree cover disturbances.

3. Member States shall collect the following forest data, in accordance with the frequency specified in Annex II :

   (a) forest available for wood supply and forest not available for wood supply;
   (b) growing stock volume;
   (c) net annual increment;
   (d) stand structure;
   (e) tree species composition and richness;
   (f) European forest type;
   (g) removals;
   (h) deadwood;
   (i) location of forest habitats in Natura 2000 sites;
   (j) abundance of common forest birds;
   (k) location of primary and old-growth forests;
   (l) protected forest areas;
   (m) production and trade of wood products;
   (n) forest biomass for bioenergy.

4. For the purposes of paragraph 3, points (a) to (h), Member States shall collect in situ data on the basis of ground surveys in combination with, where available, data from Earth Observation, and data from other relevant information sources. The ground surveys shall be based on a network of monitoring sites that are representative of, and consistent with, the Member State's forest area referred to in paragraph 2, point (a).

Article 7 – Forest data sharing framework

1. (...), the Member States shall share the latest available forest data referred to in Article 5(3) in accordance with the technical specifications set out in Annex II, by making them publicly accessible. The Member States shall ensure data harmonisation by sharing aggregated forest data in accordance with the descriptions set out in Annex II. Sharing of the geographically explicit location of monitoring sites shall be subject to the establishment of the safeguards referred to in Article 9(2).

2. The Member States and the Commission shall make publicly accessible the data referred to in Article 5(2) and (3) and in Article 8(1) in an open format that is machine-readable and that ensures interoperability and re-usability in accordance with Article 5 of Directive (EU) 2019/1024.

Current forest states will be dressed within this framework. The database that will result from this inventory will include digital models and technical drawings of forests, such as sections and plans. The scale of drawings will vary from 1:1000 for the mapping of forest units to 1:100 for the report of diversity, natural qualities and specificities found in the forest. This inventory will allow to detail forest's layers based on its structure (see *E. Criteria* and *F. Quality variables*) and dynamics according to space and time. These representations will be elaborated as a cooperation between the fields of biology, construction and architecture. This will ultimately contribute to the expansion and share of common knowledge around forestry and architectural practices.

2.7.2. Data management

Previous sections define the geographical, jurisdictional and technical scopes of the method. A clear transparency is fundamental to enable monitoring and traceability from forests to final products. Thus, centralisation and digitalisation of collected data become essential. All stakeholders taking part in the processes that involves the architectural project will report their practices in a central database accessible at a European level.

At each steps, verification of accuracy, reliability and quality of collected data will be ensured by a European government-owned first party audit body. Confidentiality have to be preserved at all costs without affecting the transparency of the method. Data ownership will be developed in section *8. Ownerships*.

Article 10 – Data quality control

1. The Commission and the Member States shall be responsible for the quality and completeness of the forest data that they collect and share under the forest monitoring system.
2. Member States shall annually assess the quality of the data shared in accordance with this Regulation. Where the assessment reveals deficiencies in the data, Member States shall adopt appropriate remedial actions. Member States shall submit to the Commission the assessment reports on the quality of data and, where appropriate, the description of the remedial actions and the timetable for their implementation by 1 July following the calendar year in which the deficiency was identified.
3. The Commission is empowered to adopt delegated acts in accordance with Article 14, to supplement this Regulation by establishing accuracy standards for data shared under this Regulation and rules on the quality assessment referred to in paragraph 2 of this Article and Article 6(2), point (c).
4. The Commission is empowered to adopt implementing acts to specify the contents of the assessment reports on the quality of data and arrangements for their submission to the Commission as well as the description of remedial actions referred to in paragraph 2, second subparagraph. Those implementing acts shall be adopted in accordance with the examination procedure referred to in Article 15(2).

Article 11 – Coordination and cooperation

1. The Member States and the Commission shall coordinate their efforts and cooperate to improve the quality, timeliness and coverage of forest data.
2. The Commission shall support the Member States, upon request, in the development or adaptation of their voluntary integrated long-term forest plans referred to in Article 13, by providing information on the state of the underlying scientific knowledge and by facilitating knowledge and good practice exchange.
3. Member States shall cooperate among each other and coordinate their actions to improve the quality, timeliness and coverage of forest data. Such cooperation and coordination shall be based on open scientific debate and shall aim to promote impartial scientific advice.
4. Member States and the Commission may use existing regional institutional cooperation structures, including those under regional Conventions and other forest relevant fora and processes.

Article 12 – National correspondents

1. Each Member State shall designate a national correspondent and shall inform the Commission thereof.
2. The national correspondent shall, in particular, carry out the following tasks:
   (a) coordinate the preparation of the forest data to be shared under this Regulation, taking into consideration all competent authorities, including those responsible for disaster risk prevention and management;
   (b) coordinate attendance of relevant experts in expert group meetings organised by the Commission and other relevant bodies.
3. The national correspondent shall serve as focal point for the exchange of information between the Commission and the Member State for the development or adaptation of the voluntary integrated long-term plans referred to in Article 13. Where several authorities in a Member State are participating in the development or adaptation of the voluntary integrated long-term forest plan, the national correspondent shall be responsible for the coordination of that work.

Article 13 – Voluntary integrated long-term plans

3. Member States shall encourage the active involvement of all interested parties in the development of their integrated long-term forest plans. Member States shall make the plans publicly available.

3. Objectives

3.1. Bridge EU latest forestry policies together to improve sustainability in forestry and design practices

Bridging latest European forest strategies, management guidelines, deforestation regulation and forest mapping and monitoring together defines common framework, scope and practices. This is a fundamental starting point to build a central database that will facilitate the analysis and evaluation of our current practices. Ultimately, the database will give inputs and variables to work from to improve sustainability in forestry and design practices.

3.2. Improve transparency throughout the whole process that imply wooden buildings design and construction

Transparency is key to approach a process as a whole and to decompose it in steps of actions. Independently and together, the identification and analysis of these different steps will give a better leverage to adapt our practices in the aim of reaching sustainability at different scales and levels.

3.3. Elaborate a method to evaluate forest's operational capacity of providing raw material

The method developed in this proposal seeks to determine the actual amount of wood that can be harvested from a forest for it to stay healthy, meaning being able to provide its ecosystem services and keeping its natural qualities and diversity. Ultimately, the method sets boundaries within which an architectural project can be designed.

3.4. Redefine architects' responsibilities in natural resources planning and uses

The way we manage and use natural resources today shape our landscapes and have big environmental and social impacts. As experts in built environment design, architects sit right at the frontier of the built and nature. They are in a key position in discussions between forestry and industries, and have an influence in the choices we make in terms of materials uses for our built environment. Now, in order to cross that border between the built and natural, architects will take part in the mapping of forests, using their spatial expertise and tools such as technical drawings. This will open the discussion and promote transdisciplinarity, to ultimately support the transparency of the whole method.

3.5. Provide a central database based on past, current and future states of forests

Each harvested forests will have to go through a mapping process. This process includes an historical analysis of the forest, a report on its current composition and dynamics, and a report on its state after harvesting. This database will be used for evaluations and decision making in regard of forest monitoring.

3.6. Database as the design thinking framework

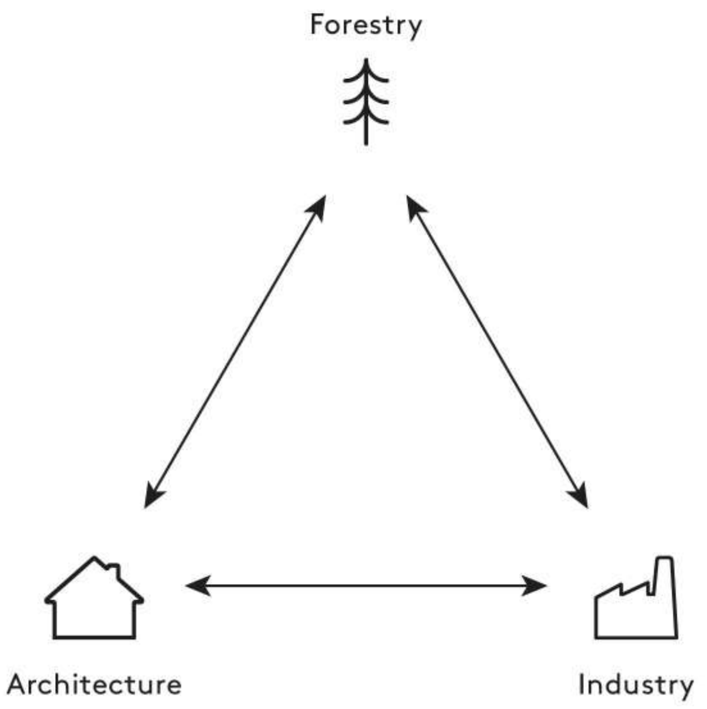
Forest management practices promoted by the method will determine industrial and design practices. They will provide a larger range in available wood products and new alternatives in wooden building design. Iterations between forestry and design will be key to reach the full potential of the method. This last point will be facilitated with new architects' role and responsibilities in natural resources planning and uses mentioned above, section *3.4.*.

3.7. Define forestry practices priorities of a local context

The method seeks to be flexible by taking into account the complexity of a natural forest structure. It is based on strict criteria and quality variables. If criteria apply and should be verified in all types of forests, the quality variables allow to work with specific contexts.

4. General principles

This proposal promotes a method where industrial and design practices are determined from a defined sustainable forest management. Thus, the method is developed around three main components that are forestry, architecture and industry. This section will identify chronologically the steps that include each components in the process of implementation. These steps will be further developed section *7. Stepwise approach of implementation*.



Material and knowledge exchanges within Forestry, Architecture and Industry sectors.
Source: Author.

4.1. Forestry

4.1.1. Mapping

The first mapping is done before harvesting. It will serve as foundations for monitoring and give data about a forest at its current stage. This mapping consists of a report based on this proposal's criteria and quality variables identification in the mapped forest.

4.1.2. Forest carbon evaluation

A carbon evaluation of the mapped forest will complement data collected from mapping. This evaluation will determine how much carbon is currently stored in the forest, and estimate the amount of carbon that the forest sinks for a year.

4.1.3. Tree classification

Mapping will specify forests' composition and structure. This analysis will result in a classification of trees found in the mapped forest, based on the *Tree classification table* provided in the proposal's appendix.

4.1.4. Selection: Preservation/Harvesting

Once mapping and classification stages completed, conditions for sustainable harvesting are set and thus enable a selection at a tree level. Respecting the guidelines defined section *10. Guidelines* of the proposal, the selection will be conducted following the principle *Should it be preserved/Could it be harvested*. Trees that have been preserved during first harvesting could potentially be harvested on a harvesting conducted later on.

4.1.5. Natural regeneration

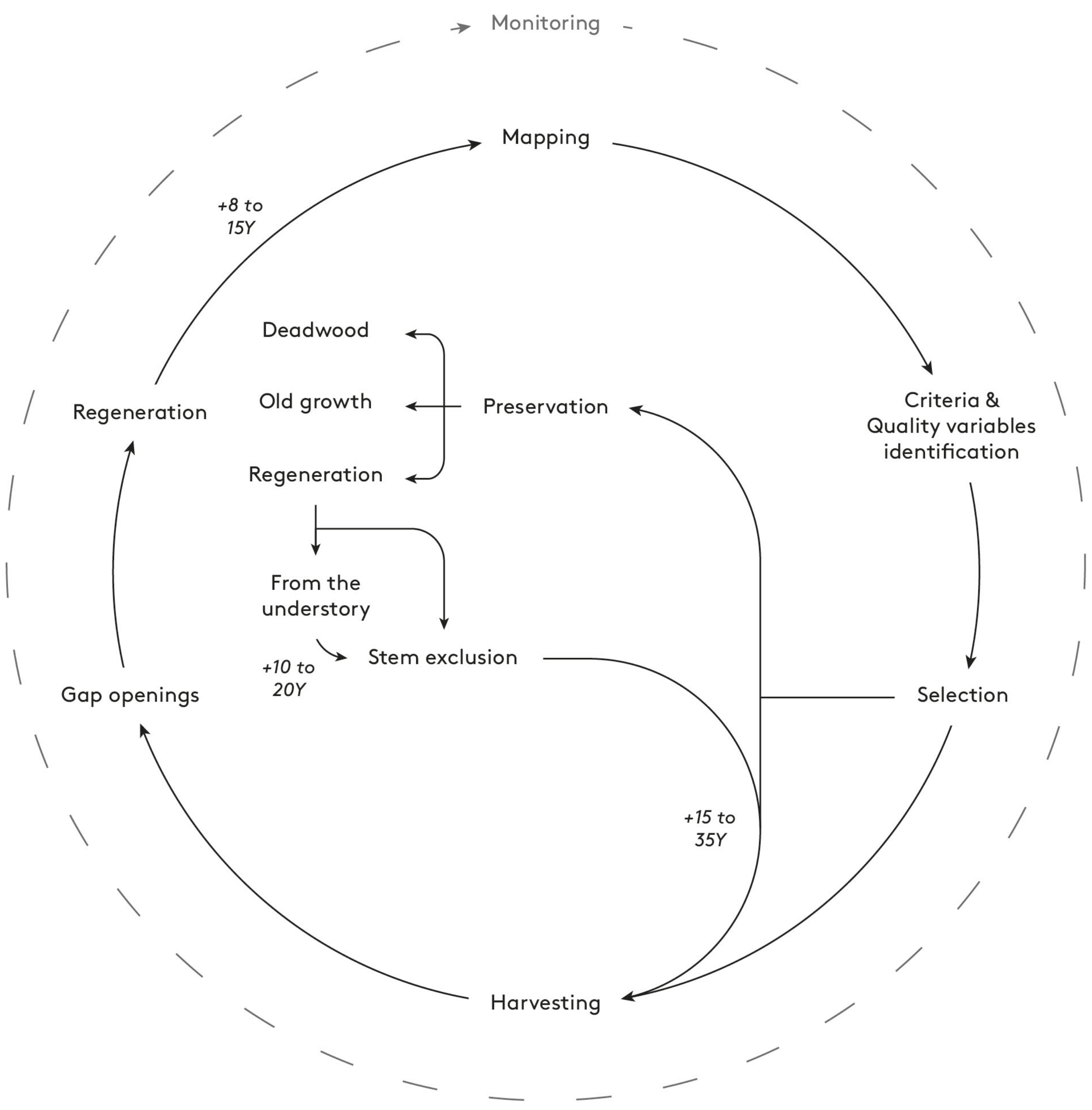
Selected harvesting will keep the ability of the forest to ensure natural regeneration of various local established species. The environmental qualities of the forest will be kept and will provide suitable conditions for the forest to complete its natural cycles.

4.1.6. Monitoring

All previous steps mentioned above will be monitored to ensure that the forest stays healthy while undergoing the forest management model promoted by the proposal's method.

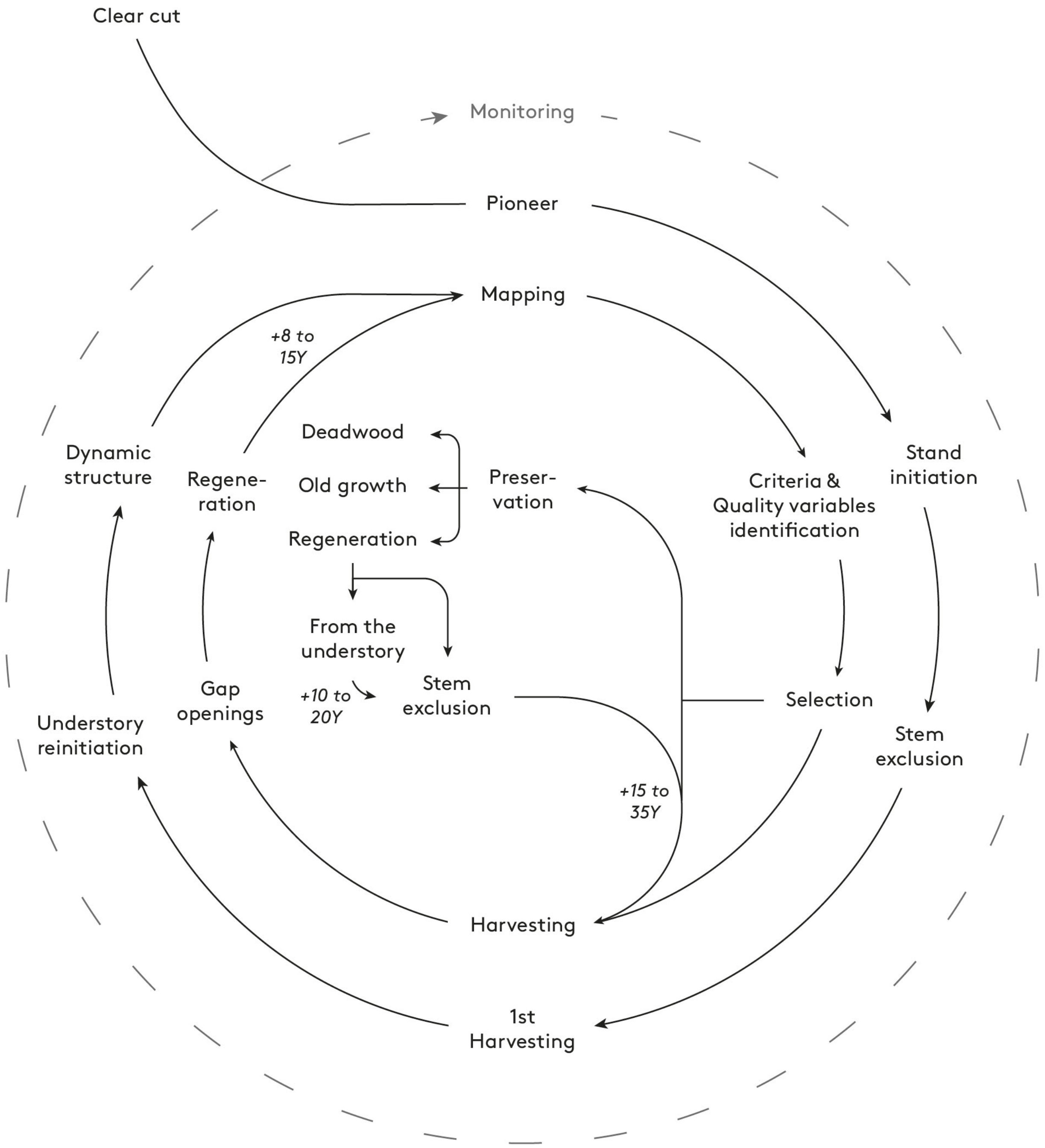
4.1.7. Mapping

Finally, as a cycle, mapping will be conducted again before next harvesting, and will lead to following steps mentioned above.



Sustainable Forest Management diagram, following *4.1. Forestry* section's principles.

Source: Author.



Sustainable Forest Management diagram, following *4.1. Forestry* section's principles after a clear-cut.
Source: Author.

4.2. Architecture

4.2.1. Wood availability

Iterations between forests and the architectural project will be facilitated. The proposal's method will provide a larger range in types of wood harvested. This will serve as a material bank in which the architectural project will seek for alternative and sustainable design proposals.

4.2.2. Project's wood needs evaluation

This stage will evaluate the project's needs in terms of wood types and amounts for the building to be fully constructed.

4.2.3. Project's design elements inventory

The architectural project will be detailed by identifying the wooden design elements that will be part of the building.

4.2.4. Project carbon emissions evaluation

This stage will be done in relation to stage *4.1.2. Forest carbon evaluation*. The aim is to balance the carbon emissions resulting of the project with the carbon sinked by the harvested forests that provided materials for the project.

4.2.5. Project's final design

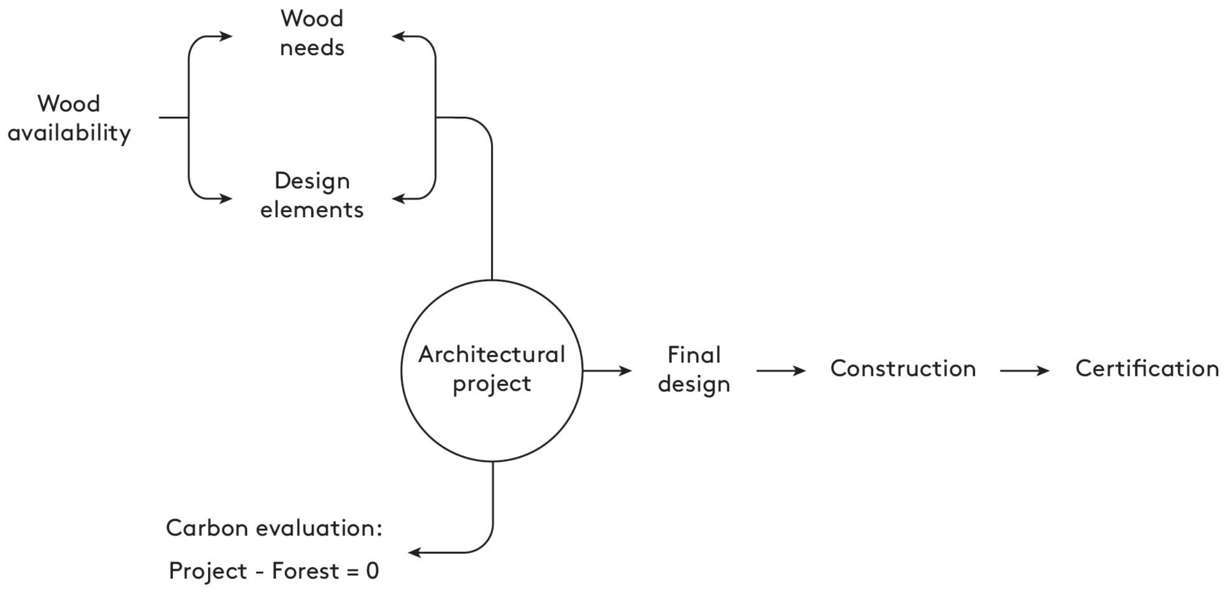
Based on stages mentioned above, a final design proposal will be presented. This design proposal will result of design explorations determined by the material and immaterial outcomes provided by the harvested forests.

4.2.6. Construction

The building is finally being built.

4.2.7. Certification

The harvested forests and final building are linked together by a certification that guarantees that the proposal's method has been followed in its integrity.



Sustainable design of wooden buildings diagram, following *4.2. Architecture* section's principles.
Source: Author.

4.3. Industry

4.2.3. Project's design elements inventory

The architectural project will be detailed by identifying the wooden design elements that will be part of the building.

4.3.1. Wood availability

Wood is being classified, marked and collected from harvesting site. Classification is made from the size and quality (straightness, abundance of branches, wounds...) of each round logs.

4.3.2. Transport to primary processing site

Wood is being transported from harvesting site to the primary processing site.

4.3.3. Primary processing

This stage distinguishes log only inputs (plywood, veneer and sawmill) from log and other inputs (flooring, board, pulp, paper, fuelwood).

4.3.4. Transport to secondary processing site

Primary products are being transported from the primary processing site to the primary processing site.

4.3.5. Secondary processing

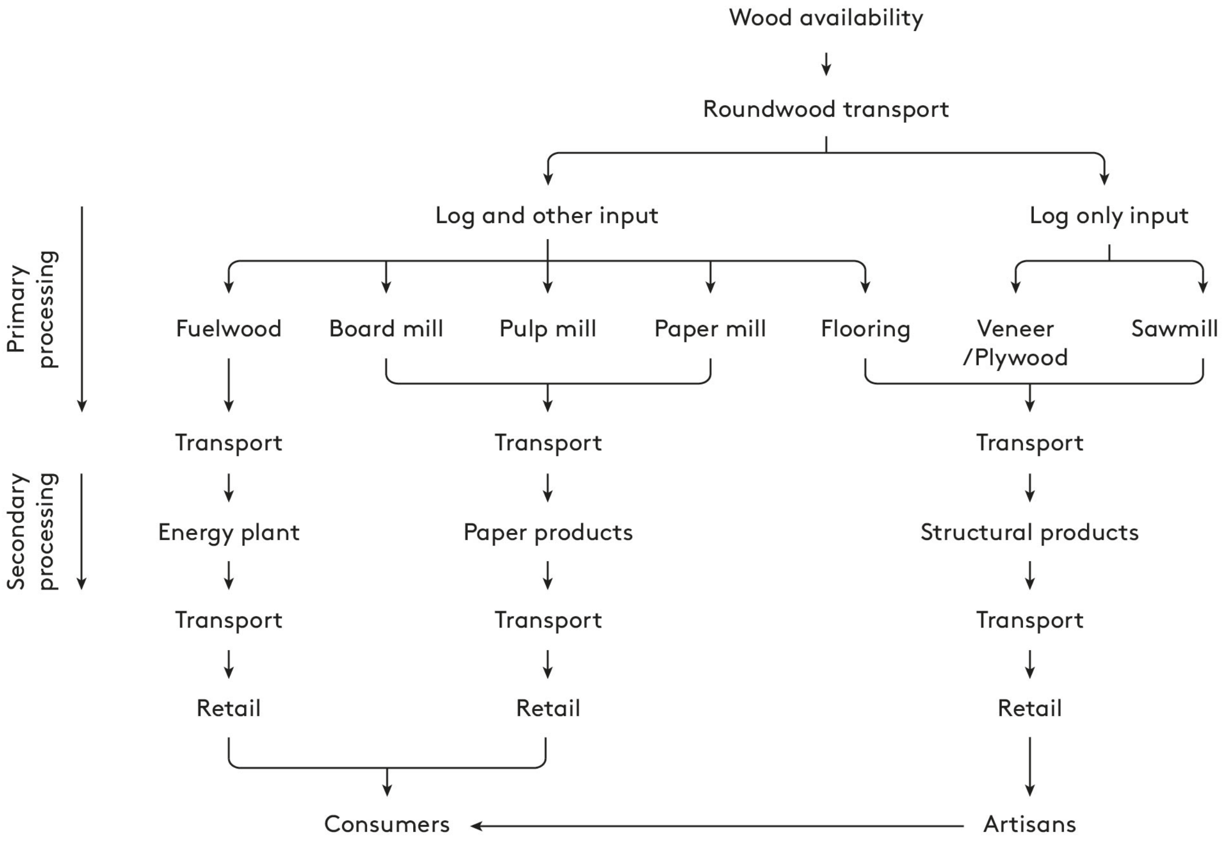
This stage distinguishes structural, paper and energy products.

4.3.6. Transport to retail center

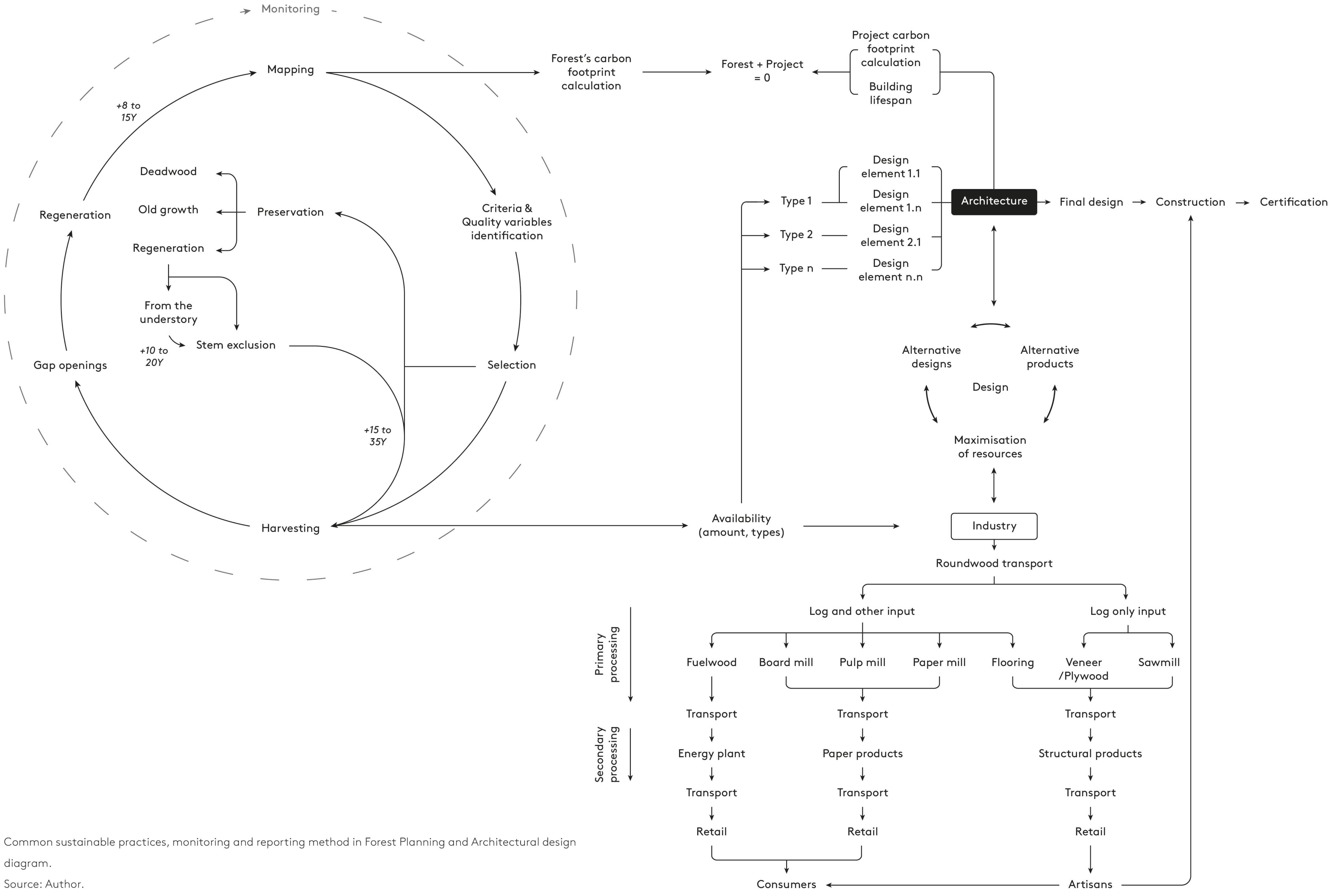
Final products are being transported from the secondary processing site to retail centers.

4.3.7. Final use

Wood products find their final use. This includes packaging, energy, and construction (see section *4.2.6. Construction*).



Timber traceability diagram, following *4.3. Industry* section's principles.
Source: Author.



Common sustainable practices, monitoring and reporting method in Forest Planning and Architectural design diagram.
Source: Author.

5. Targets

This section defines a set of targets as a toolbox to which forest management practices can refer to. These targets seeks to be flexible tools to adapt practices to different contexts, scales and timeline. They are based and put in relation Closer-to-Nature forestry principles with criteria and quality variables defined in sections *2.2.*, *2.5.* and *2.6.*.

For each harvested forest, 3 targets will be specifically chosen and guide forestry practices before, during, and after harvesting. These targets will be particularly followed at each forest monitoring stages.

As for evaluation, the evolution of each targets' states will be conducted in relation to measures provided section *10. Core elements*.

5.1. Develop forest composition diversity

Composition refers here to the range of tree species that can be found in the forest. Depending on the natural context where the forest is established, a mixed composition with evergreens and deciduous trees will be promoted.

5.2. Develop forest structure diversity

Structure refers here to trees' age and origins. With natural regeneration as a main principle, forest's structure becomes more uneven and gain in complexity following forests' natural cycles.

5.3. Tree cover extension

This targets evaluates on a plan the total surface covered by trees. This includes the evolution of canopy cover as well as forests' stems density.

5.4. Increase old or large trees ratio

This target calculates the percentage in terms of biomass of old or large trees found in a forest.

5.5. Preservation of regeneration patches already established on site

This target aims to ensure forest's succession by preserving patches of saplings and young trees resulting from natural regeneration already established on site.

5.6. Protection of endangered species

When a forest is established in an area where endangered fauna and flora species can be found, forest management practices should not disturb the ecosystems that depend on those species. Precautions should be taken, and monitoring should have included an adapted timeframe and specific criteria to measure.

5.7. Restore soil

Soil should preserves its filtering and retention qualities of water, nutrients and carbon. If those conditions have been altered from previous climate events or human activities, forest management practices should permit their restoration.

5.8. Restore water bodies and streams

Natural water flows should be ensured and no prone to pollution. When ditches have been dug, restoration projects can be conducted together with Closer-to-Nature forest management practices to restore the natural qualities and dynamics of the site.

6. Benefits

Our view on forests evolves with our societies' needs and demand. Lately, the importance given to the environmental and social values of a forest started to increase, alongside with our awareness on climate change. In addition, with a high and increasing demand on wood products, the economic values of forests are to be considered as one of the main values held by forests.

This section goes through the main benefits of the proposal's method on the environmental, economic and social values of forests.

6.1. Environmental benefits

6.1.1. Heterogeneous structure

Forests adopt a dynamic structure and become multigenerational, uneven aged, as opposed to planted monospecies forests. Such structure supports biodiversity and forests ecosystem services.

6.1.2. Heterogeneous composition

Forests are composed of mixed species, with endemic species, evergreens and deciduous trees. The flora is adapted to the local environment conditions and ecosystems.

6.1.3. Natural regeneration

Heterogeneous structure and composition provide ideal germinating and growing conditions for natural regeneration, thus support forest's natural cycles establishment.

6.1.4. Resilience

Forests build a better tolerance and adaption to climate change conditions, extreme weather events, pests and diseases.

6.1.5. Soil conditions

Closer-to-Nature forest management practices rely on methods that avoid soil compaction and erosion. This prevent carbon release in the atmosphere and water flows alterations, improving water quality.

6.1.6. Canopy cover preservation

Preserving a certain percentage of canopy cover after harvesting provide good light conditions for natural regeneration while intercepting airborne pollutants.

6.1.7. Harvesting scales

Selected harvesting support wildlife by maintaining habitats interconnections on a larger scale than the harvested forest.

6.2. Economic benefits

6.2.1. Supply and demand evaluation coordination

Forest monitoring and mapping gives a clear picture of wood supply. When put in relation with demand, it helps to maximise the resource value by determining the actual value of a specific type of wood material.

6.2.2. Harvesting outcomes diversity

Growing and harvesting various tree species give a leverage at medium term and ways to adapt to timber prices fluctuations. It opens the possibilities to harvest different wood types and qualities.

6.2.3. New business opportunities

Taking into consideration new forests' values such as carbon removals and ecosystem services, the method supports the development of new markets, opening new job opportunities.

6.2.4. Increase efficiency of supply network

The transparency of the whole process that the method enables facilitates monitoring and decision making in response measures to identified issues at specific stage of the process.

6.2.5. Transdisciplinarity and cooperation

Developed around a common database, the method breaks the boundaries between fields and facilitates communication and exchange of knowledge.

6.2.6. Common regulation framework

Inspections, monitoring and measures will be taken in the scope of the same jurisdictional framework. Regulations are defined at European level by the European Commission. See sections *2.2.*, *2.3.* and *2.4.* for more precisions on regulations.

6.2.7. New funding opportunities

Stakeholders following the method can benefit from EU funding and support programs.

6.3. Social benefits

6.3.1. Gives voice to people

Developed around a common EU regulation framework, the method improves forest governance by increasing monitoring and reducing the impacts of industries in the fields.

6.3.2. Deforestation free wood products

Providing timber traceability, the transparency of the method throughout the whole process allows to control and ensure that all wood products have not been produced on deforested lands.

6.3.3. Landscape

Avoid deforestation and land degradation favours the preservation of traditional landscapes. These landscapes carry local history and often represent the identity of a place.

6.3.4. Tourism

Specificities of traditional landscapes mentioned above section 6.3.3. also favour tourism and eco-tourism. Tourism bring its dynamics and plays an important role in rural places' life.

6.3.5. Well-being and healthy living

Healthy forests provide a natural structure that supports outdoor recreation activities, favouring well-being and healthy living of society.

6.3.6. Forests partnerships

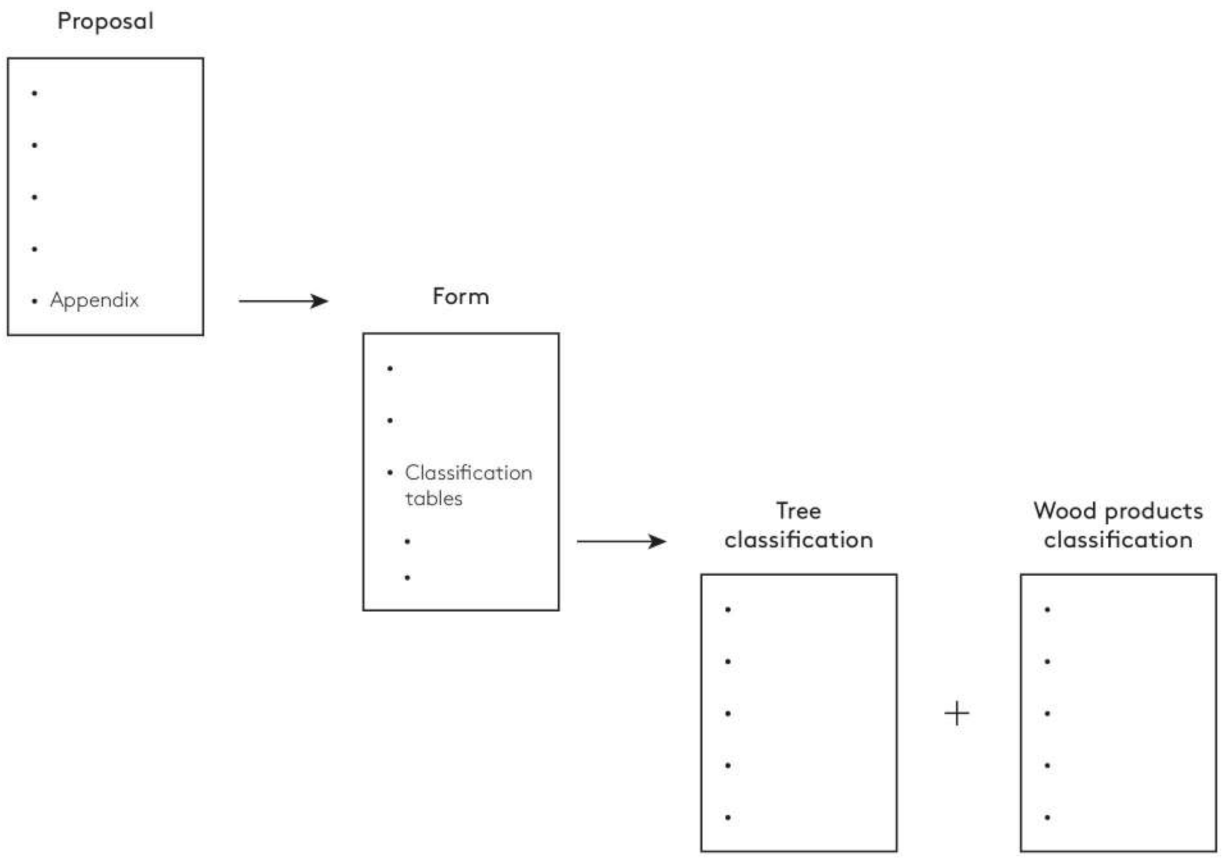
The method promotes forests partnerships within Europe, leading to the development of projects, tourism, and opening international opportunities for European rural areas.

7. Stepwise approach of implementation

This section looks at how the general principles developed section *4. General principles* are reported for monitoring in practice through the process of implementation.

The method provides a form (see annexe 1) that will be filled at the start of the architectural project. The form is articulated in four different sections in relation to the main components that are forestry, architecture and industry. Each chapter seeks to detail specific variables involved in the process in order to provide relevant data to ensure clear transparency.

The *Forest* section will be detailed based on the *Tree classification* table's classification keys provided in appendix. The *Architecture*, *Primary processing* and *Secondary processing* sections will be detailed based on the *Wood products classification* table's classification keys provided in appendix.



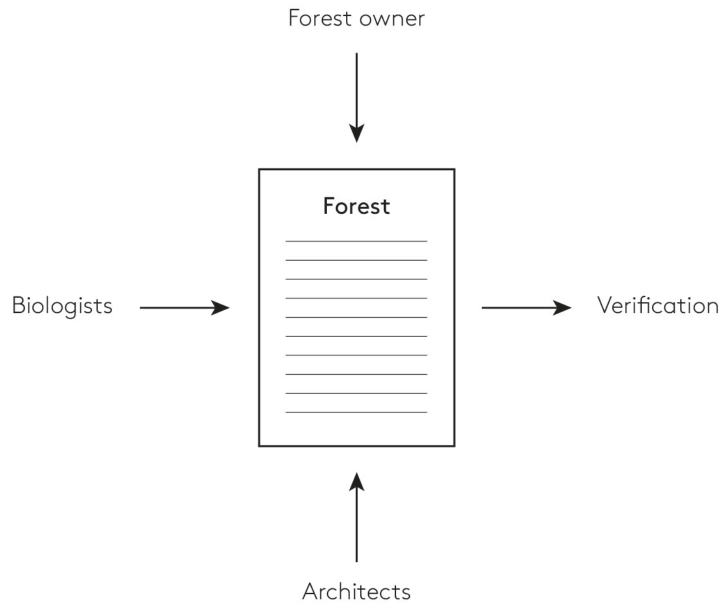
Proposal's branching diagram.

Source: Author.

7.1. Forest

This section of the form gives indications on the harvested forest. Information regarding its location, ownership and management are reported by the forest owner. In addition to this, mapping and inventory is done by architects and biologists. Mapping reports forest's past, current and future states after harvesting. Pictures, plans, sections and 3D models will be provided as part of mapping, as graphical descriptions of the forest's state.

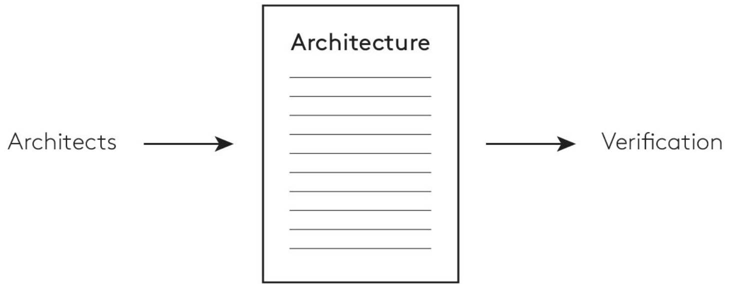
Inventoring is done based on tree classification keys, provided in the tree classification table (see annexe 2). These keys give specifications on tree species, conditions, growth stage, and on environmental and harvesting qualities.



Form's Forest section inputs diagram.
Source: Author.

7.2. Architecture

This section of the form gives indications on the architectural project. Information regarding the architecture agency and project description are provided by the architectural agency working on the project. The data include identification and location of the agency, as well as responsibilities in the project, needs in wood and project's carbon evaluation.

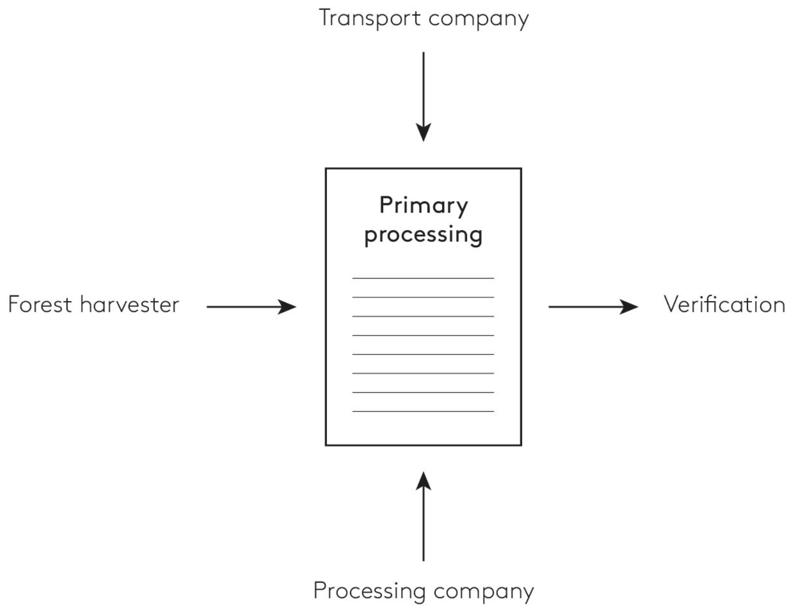


Form's Architecture section inputs diagram.
Source: Author.

7.3. Primary processing

This section of the form gives indications on the primary processing stage. It details the process from the marking of harvested logs in the forest to the primary processing outcomes. The section includes information regarding transport company, ways of transport, and material outcomes from processing (wastes and products). Data is provided by forest harvesters, transporters and processing companies.

Specifications on processing outcomes are based on wood products classification keys, provided in the wood products classification table (see annexe 3). These keys determine the categories of the final wood products after primary processing: roundwood, fuelwood, sawnwood, panel, pulp, paper, cork...

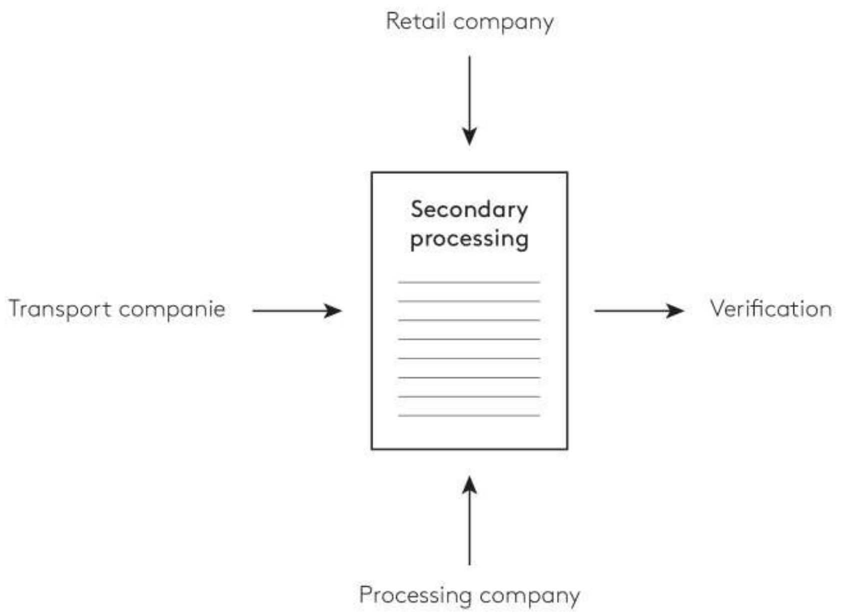


Form's Primary processing section inputs diagram.
Source: Author.

7.4. Secondary processing

This section of the form gives indications on the secondary processing stage. It details the process from the moment wood products leave the primary processing site to secondary processing site and retailing. The section includes information regarding transport company, ways of transport, and material outcomes from processing (wastes and products). Data is provided by transporters, processing and retail companies.

Specifications on processing outcomes are based on wood products classification keys, provided in the wood products classification table. These keys determine the categories of the final wood products after primary processing: roundwood, fuelwood, sawnwood, panel, pulp, paper, cork...



Form's Secondary processing section inputs diagram.
Source: Author.

8. Ownership

The method developed in this proposal identifies steps in the process of wooden building construction and helps to name stakeholders involved in each of these. Internal audit is crucial at each steps to allow for evaluation and improvement. However, timber industry can be at risk for corruption thus measures in timber traceability have to be taken for transparency and impartiality. In addition to internal audit, external audit will be conducted throughout the whole process at every stages.

Since the method lies on the latest European forest policies, external audit will be ensured by European government-owned first party audit body. All data collected, audited and shared will be under the ownership of European government.

9. Guidelines

This section defines guidelines for good practices in forestry, architecture and during the industrial processes, aligned with the proposal method. It precises quantitative and qualitative delimitations of the criteria (section *2.5.*), quality variables (section *2.6.*) and general principles (section *4.*).

9.1. Guidelines for forestry

- Species diversity: All species present before harvesting will be present after harvesting. Special attention will be given to native species. Non-native tree species will not be removed if they do not significantly disturb ecological processes.

- Canopy cover: Canopy cover will be maintained at 50% minimum over the global surface of the harvested forest. Gaps created from harvesting will not exceed 0.05 ha. The gaps are varied in shapes and sizes, will not affect forest's stability, and be based on light-access needs of surrounding tree species to allow natural regeneration.

- Biomass volume: Do not harvest more than 50% of a same species in terms of above-ground biomass. Below-ground biomass of harvested trees will not be excavated.

- Structural complexity: Do not harvest more than 75% of a same tree range. Tree range is defined by a tree's trunk diameter at breast height and tree's canopy height.

- Regeneration patches: When 0.025 ha or more and composed of 5+ years old saplings, regeneration patches will not be altered by harvesting processes.

- Deadwood: The method aims to find a minimum of 20 m3/ha of deadwood, including lying and standing deadwood.

- Resilient trees: Resilient trees will be identified before harvesting. An area of 0.015 ha centred at its trunk will not be altered by harvester machines.

- Habitat trees: Habitat trees will be identified before harvesting. An area of 0.015 ha centred at its trunk will not be altered by harvester machines.

- Old or large trees: A tree that has reached 100 years old or half of its species life expectancy on the specific site will not be harvested.

- Stand origin: The method favours natural regeneration but allows for plantations. When plantation is done, it will be limited to local species and will respect local species diversity and forest's current stage of growth.

- Indicator species: Tree species of late-seral developmental phases and species listed on the red list of the International Union for Conservation of Nature (IUCN) will not be harvested. Special attention for protection to these will be given during harvesting.

- Seed bearing trees: When found on site, seed bearing trees' distribution will be preserved across the whole harvested area.

- Harvesting frequency: 10 years should separate two harvestings of a same tree range.

- Compact and light tracked skidder and harvester machines. Manual tree falling and horse skidding being considered as the lowest impact interventions in a forest.

9.2. Guidelines for architecture and industry

• Forest capacity: Forest mapping will evaluate forest's final capacity in terms of wood availability, taking into consideration biodiversity and carbon cycles.

• Project's carbon footprint: Carbon emissions resulting of the project will be balanced by the harvested forest(s) in 10 years maximum.

• Forest mapping roles: Forest mapping will be done by a team of biologists and architects with the aim of sharing knowledge between the fields. In addition, by taking part in the mapping process, architects will be exposed to practical situations, thus get a better understanding of relations between the tree, its material and final use. This should help in opening possibilities within the forestry industry.

• Iterations: Forest mapping will enable iterations between project, forest and industry, thus will deepen understanding and possibilities of what a natural forest can offer to the architectural project within its ecological boundaries.

• Design: Architects and engineers will work in cooperation on alternative structural wood products research projects. These projects will feed a database of alternative structural wood products. As references, architects will look in the database after the mapping of aforest to seek for alternative design elements to use in the project. Industries will use the database to develop flexible industrial processes of production of the alternative structural wood products listed.

• Wood products inventory: The design process of a wooden building will provide a wood products inventory regarding the needs (types and amounts) for the building to be constructed. The wood products listed in the inventory will refer to the alternative structural wooden products database mentioned above.

• Graphical clarity: Forest mapping allows inventory and classification, thus should clearly show graphically the criteria listed section *2.5.* and quality variables listed section *2.6.*.

Appendix

Annexe 1

Reporting Form

Forest

Identification	
Parcel's administrative code	
Address	
GPS coordinates	
City	
Country	
Code	
Owner	
Address	
Street, No.	
City	
Country	
Code	
Contact person	
Telephone	
E-mail	
Characterisation	
History	
Origins	
Current forest's stage of growth	
Current state	
Plans	*Refer to annexe 1.1 - Criteria and Quality variables mapping*
Sections	*Refer to annexe 1.2 - Criteria and Quality variables mapping*
Species inventory	
Targets	
Annual growth (biomass)	
Carbon footprint	
Annual	
Projected (10y)	
Photographic report before harvesting	*Refer to annexe 1.3*
Management	
Regime	
Day of harvesting	
Method of harvesting	
Logger company	
Address	
Street, No.	
City	
Country	
Code	
Contact person	
Telephone	
E-mail	
Website	
Harvested trees marked on plan	*Refer to annexe 1.4*
Plans after harvesting	*Refer to annexe 1.5*
Sections after harvesting	*Refer to annexe 1.6*
Photographic report after harvesting	*Refer to annexe 1.7*

Annexe 1.1

Plans - Criteria and quality variables mapping

Annexe 1.2

Sections - Criteria and quality variables mapping

Annexe 1.3

Photographic report before harvesting

Annexe 1.4

Harvested trees marked on plan

Annexe 1.5

Plans after harvesting

Annexe 1.6

Sections after harvesting

Annexe 1.7

Photographic report after harvesting

Architecture

Organisation	
Organisation’s name	
Organisation’s representative	
Address	
Street, No.	
City	
Country	
Code	
Website	
Contact person	
Telephone	
E-mail	
Website	
Project	
Project name	
Project’s leader	
Project brief	
Project location	
Street, No.	
City	
Country	
Code	
Needs	
Product’s name	
Product’s code	
Product’s species	
Volume	
Product’s name	

Product's code	
Product's species	
Volume	
Product's name	
Product's code	
Product's species	
Volume	
Building's lifespan	
Building's carbon footprint	

Primary processing

From forest to primary processing site	
Transport company	
Address	
Street, No.	
City	
Country	
Code	
Contact person	
Telephone	
E-mail	
Website	
Vehicle	
Model	
Year	
Itinerary from depot to the forest	
Itinerary from forest to primary process site	
Loads	
Itinerary from process site to depot	
Primary processing site	
Production (see product classification)	
Product name	
Product code	
Product species	
Volume	
Waste (see product classification)	
Product name	
Product code	
Product species	

Product species	
Volume	
From primary processing site to retail	
Transport company	
Address	
Street, No.	
City	
Country	
Code	
Contact person	
Telephone	
E-mail	
Website	
Vehicle	
Model	
Year	
Itinerary from depot to secondary process site	
Itinerary from secondary process site to retail	
Loads	
Itinerary from retail to depot	
Retailing	
Retail company	
Address	
Street, No.	
City	
Country	
Code	
Contact person	

Telephone	
E-mail	
Website	
Inventoring	
Product name	
Product code	
Product species	
Volume	

Volume	

Secondary processing

From primary to secondary processing site	
Transport company	
Address	
Street, No.	
City	
Country	
Code	
Contact person	
Telephone	
E-mail	
Website	
Vehicle	
Model	
Year	
Itinerary from depot to primary process site	
Itinerary from primary to secondary process site	
Loads	
Itinerary from process site to depot	
Secundary processing site	
Production (see product classification)	
Product name	
Product code	
Product species	
Volume	
Waste (see product classification)	
Product name	
Product code	

Annexe 2

Tree classification table

Categories	X	Code
Specie		01000
Evergreen		01010
Deciduous		01011
Endemic		01020
Non-endemic		01021
Invasive		01030
Specie key		XXXXX
Condition		02000
Lying deadwood		02010
Standing deadwood		02011
Scenescent		02020
Resilient		02030
Healthy		02040
Condition key		XXXXX
Dynamic		03000
Sapling		03010
Understory		03011
Open light		03012
Stem exclusion		03020
Maturity		03030
Old growth		03040
Dynamic key		XXXXX
Environmental qualities		04000
Seed bearing		04010
Habitat tree		04020
Cavity		04021
Cavity with mould		04022
Canopy deadwood		04023
Fruit bodies of saproxylic fungi		04024
Root buttress cavity		04025
Cracks		04026
Fork split		04027
Burr		04028
Environmental qualities key		XXXXX
Harvesting qualities		05000
Structural		05010
Pulp		05020
Energy		05030
Harvesting qualities key		XXXXX

Annexe 3

Wood products classification table

Categories	X	Code
Roundwood		01000
Sawlogs and veneer logs		01010
Pulpwood		01020
Chips and particles		01030
Wood residues		01040
Other industrial roundwood		01050
Roundwood key		XXXXX
Fuelwood and charcoal		02000
Fuelwood (incl chips, residues, pellets, brickets, etc.)		02010
Charcoal		02020
Fuelwood and charcoal key		XXXXX
Sawnwood and sleepers		03000
Railway sleepers		03010
Sawnwood		03020
Sawnwood and sleepers key		XXXXX
Engineered wood products		04000
Laminated Lumber Products		04010
Finger Jointed Lumber		04020
Glue Laminated Products (Glulam)		04030
Laminated Veneer Lumber (LVL)		04040
Parallel Strand Lumber (PSL)		04050
I-Joists / I-Beams		04060
Trusses & Engineered Panels		04070
Other		04080
Engineered wood products key		XXXXX
Wood based panels		05000
Veneer sheets		05010
Plywood		05020
Particle board		05030
OSB		05031
Other particle board		05032
Fibreboard		05040
MDF		05041
HDF		05042
Softboard		05043
Hardboard		05044
Insulating board		05045
Wood based panels key		XXXXX
Pulp		06000
Mechanical		06010
Semichemical		06020
Dissolving		06030
Chemical		06040
Unbleached sulphite pulp		06041
Bleached sulphite pulp		06042
Unbleached sulphate (kraft) pulp		06043
Bleached sulphate (kraft) pulp		06044
Recovered paper		06050
Pulp key		XXXXX
Paper and paper board		07000
Graphic papers		07010
Newsprint		07011
Uncoated mechanical		07012
Uncoated woodfree		07013

Coated papers		07014
Household and sanitary paper		07020
Packaging materials		07030
Case materials		07031
Folding boxboards		07032
Wrapping papers		07033
Other papers mainly for packaging		07034
Other paper and paperboard		07040
Converted paper products		07050
Printed matter		07060
Paper and paper board key		XXXXX
Wood manufacturers		08000
Packaging, cable drums, pallets		08010
Packaging and crates		08011
Cable drums		08012
Pallets		08013
Furniture		08020
Builders carpentry		08030
Windows		08031
Doors		08032
Shingles and shakes		08033
Floors		08034
Others		08035
Decorative wood		08040
Tools and turned wood		08050
Tools		08051
Children toys		08052
Sport goods		08053
Musical instruments		08054
Other		08055
Other		08060
Wood manufacturers key		XXXXX
Exterior products		09000
Buildings and their parts		09010
Garden Furniture/Outdoor products		09020
Garden furniture		09021
Playground equipment		09022
Decking		09023
Other		09030
Exterior products key		XXXXX
Cork and cork products		11000
Natural cork and cork waste		11010
Cork manufactures		11020
Cork and cork products key		XXXXX
Energy		12000
Non-wood products		13000
Other		14000